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SAMSUNG ELECTRO-MECHANICS

The 1nside Edge that shapes the Future

Samsung Smart GPS Hardware Specifications

Product No. : GPS22B01007

Version 0.1

This document specifies the electrical, mechanical, and behavioral characteristics of Samsung Assisted GPS Subsystem.

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1. Introduction

This document specifies the electrical, mechanical and behavioral characteristics of Samsung Smart GPS (SSG). The SSG is illustrated in figure 1 below. The SSG is a high sensitivity, low power device tracks GPS satellites to compute current position, velocity and time information. The SSG is based on the fast and deep GPS signal search capabilities of SiRFstarIII™ architecture. The SSG has 1 SiRFstarIII™ IC, Battery, Diode, PCB, Patch Antenna, R,C, etc. And The SSG shall be available in a 3.3V~3.9V version.

The SSG interfaces vehicle electronic processor (navigator, telematics product) or phone call processor to communicate for data and command and is designed to allow quick and easy integration into GPS-related applications such as:

- PDA, Pocket PC, and other computing devices
- Car and Marine Navigation
- Fleet Management/Asset Tracking
- Automatic Vehicle Location (AVL) and Location-Based Services
- Hand-Held Devices for Personal Positioning and Navigation

The installation of the SSG is intended to be inside the application products for protection. To operate the SSG, S/W protocol and external circuit described in this document are needed.

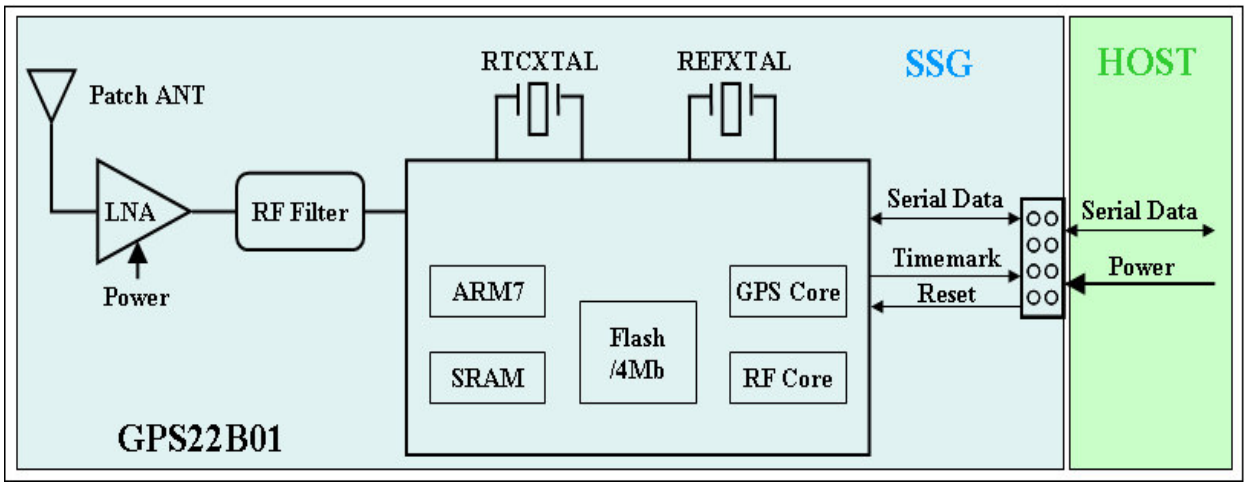


Figure 1 Block diagram

2. Product Requirements

2.1. Marking

▪ **External label**

Product number, Software version & type should be included.

Note: Please refer to **<6. Interface Specifications>** for the details.

2.2. Mechanical specifications

Table 1 Mechanical specification

Items	Description
Width	25 mm (0.98 inch)
Length	28 mm (1.1 inch)
Height	7.4 mm (0.29 inch)
Weight	8.8 g

Note: Please refer to **<7. Mechanical Dimensions>** for the details.

2.3. Interface specifications

Table 2 Interface specifications

Items	Description
I/O	7 Circle ports for soldering
	12505WR-06 pin connector

Note: Please refer to **<Appendix C. 12505WR-06 Pin datasheet>** for the details.

2.4. Material requirements

The shield case is made of metallic material for suppressive RF radiation.

2.5. Printed Circuit Board

Completed circuits may be selectively coated with an acrylic resin, air/oven cured conformal coating, clear lacquer or corresponding method which gives electrical insulation and sufficient resistance to corrosion.

2.6. Temperature requirements

Table 3 Temperature requirements

Item	Description
Operating temperature	-30℃ to +80℃
Backup Operating temperature	-20℃ to +60℃ (This temp. depend on Battery spec.)
Storage temperature	-40℃ to +85℃
Max temperature	235℃, 10sec

2.7. Electrical protection requirements

All inputs and outputs of SSG must be protected against all RF radiation by using external capacitors.

3. Electrical Specifications

3.1. Absolute Maximum Ratings

Table 4 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power Supply Voltage	VCC	-0.3	6.0	V
Storage Temperature	TSTG	-40	85	℃
High Level Input Voltage,data bus	VIH	2.1	3.1	V
Low Level Input voltage,data bus	VIL	-0.3	0.8	V

3.2. Recommended Operating Conditions

Table 5 Recommended Operating Conditions

Item	Symbol	Min	TYP	Max	Unit
Operating Temperature	TA	-20	25`	+60	℃
Power Supply Voltage ±0.5%	VCC	4.0	5.0	5.5	V

3.3. Power consumption

Table 6 Recommended Operating Conditions

State	Min	TYP	Max	Unit
Operating (@5V input)	40	50	90	mA
Sleep (only RTC operating)	5	6	10	uA

3.4. Dynamic conditions

Table 7 Dynamic conditions

Item	Description
Altitude	18,000 meters (60,000 feet) max.
Velocity	515 meters/second (1000 knots) max.
Acceleration	4g, max.
Jerk	20 meters/second3, max.

3.5. Inputs

All Power inputs should have EMI filtering (4.7uF, 10nF, 12pF) on the external circuit.

- **B/S (Boot Select)**

This pin is for the factory mode. SSG use this pin for booting the internal flash memory. This pin should be high(3Vdc) when the program is downloaded. If this pin is high status, this pin wait to download to internal flash.

Note: User has to keep NC for normal operation

- **B/U (Back Up)**

This pin is for SLEEP status.

Note: User has to keep NC for stable operation

3.6. Interface

- **UART**

This port is provided by SSG through 7 Circle ports and 12505WR-06 pin connector. This should be RS232 compatible. This port outputs NMEA 0183Data format (ver.3.0).

UART driver is capable of transferring and receiving strings of characters via the serial communication port.

Max Baud-rate can be used to extend this up to 115200 baud if required. Default Baud-rate is 9600.

Note: To use serial communication, RS-232 chip should be installed in an external circuit..

3.7. RF Connections

SSG Do Not Need RF Connection because It has patch Antenna.

4. Performance

4.1. TTFF (Time To First Fix)

Hot Start

A Hot start procedure occurs when the receiver is reset without disturbing any data held by the receiver. This can be done by toggling the system power on H/W side or selecting hot start mode in the analyzer software on S/W side.

Warm start

A Warm start procedure occurs when the receiver is reset but with invalid ephemeris data. This test is similar to keeping the receiver to be left off overnight, when almanac data, time and last known position are still valid.

Cold start

Cold start procedure occurs when the receiver is reset and no aiding data is available. This test is similar to the receiver being powered in the first time. On MDT(phone), this can be achieved by disconnecting the power while the main power (battery) is removed without information. (no store command)

- **Conventional mode**
  - (95%) @-130dBm (4 sat fix, 9 sat search, mask angle : 7degree)

Table 8 TTFF at cold/warm/hot start

	Min.	Typ.	Max	Units
Cold Start	-	45	75	Sec
Hot Start	-	5	10	Sec

4.2. Sensitivity

- **Conventional mode**
  - (95%) @-130dBm (4 sat fix, 9 sat search, mask angle : 7degree)

Table 9 Sensitivity

	Min.	Typ.	Max	Units
Acquisition	-	-142	-138	dBm
Navigation	-	-155	-152	dBm
Tracking	-	-159	-153	dBm

4.3. Accuracy

- **Static accuracy**
  - 5 meter (2DRMS DGPS, 4 sat fix, 9 sat search, mask angle : 7degree)

- **Dynamic accuracy**
  - 30 meter (CEP, 4 sat fix, 9 sat search, mask angle : 7degree)

5. Protocol Specification

Samsung GPS receiver supports a subset of the NMEA-0183 standard for interfacing marine electronic devices as defined by the National Marine Electronics Association. The NMEA Reference Manual provides details of NMEA messages developed and defined by Samsung & SiRF. It does not provide information about the complete NMEA-0183 interface standard.

5.1. Output messages

Table 8 lists each of the NMEA output messages specifically developed and defined by Samsung & SiRF for use within Samsung GPS receiver.

Table 10 NMEA Output Messages

Option	Description
GGA	Time, position and fix type data.
GLL	Latitude, longitude, UTC time of position fix and status.
GSA	GPS receiver operating mode, satellites used in the position solution, and DOP values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation,azimuth, and SNR values.
MSS	Signal-to-noise ratio, signal strength, frequency, and bit rate from a radio-beacon receiver.
RMC	Time, date, position, course and speed data.
VTG	Course and speed information relative to the ground.

A full description and definition of the listed NMEA messages are provided by the next sections of this chapter.
Table 9 provides a summary of supported Samsung & SiRF NMEA output messages by the specific Samsung platforms.

Table 11 Supported NMEA output messages

SiRF Software Options				
Message	**GSW2**	**SiRFXTrac**	**GSW3**	**SiRFLoc**
GGA	Yes	Yes	Yes	Yes
GLL	Yes	Yes	Yes	Yes
GSA	Yes	Yes	Yes	Yes
GSV	Yes	Yes	Yes	Yes
MSS	Yes	No	Yes	No
RMC	Yes.	Yes.	Yes.	Yes.
VTG	Yes	Yes	Yes	Yes

- **GGA —Global Positioning System Fixed Data**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 10 contains the values for the following example:

```
$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18
```

Table 12 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 11
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude1	9.0	Meters	
Units	M	Meters	
Geoid Separation1		Meters	
Units	M	Meters	
Age of Diff. Corr.		Second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR><LF>			End of message termination

Samsung GPS receiver does not support geoid corrections. Values are WGS84 ellipsoid heights.

Table 13 Position Fix Indicator

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3 ~ 5	Not Supported
6	Dead Reckoning Mode, fix valid

Note – A valid position fix indicator is derived from the SiRF Binary M.I.D. 2 position mode 1. See the SiRF Binary Reference Manual.

▪ **GLL—Geographic Position - Latitude/Longitude**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 12 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table 14 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00)
Checksum	*2C		
<CR><LF>			End of message termination

▪ **GSA—GNSS DOP and Active Satellites**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 13 contains the values for the following example:

$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,1.8,1.0,1.5*33

Table 15 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 14
Mode 2	3		See Table 15
Satellite Used1	07		SV on Channel 1
Satellite Used1	02		SV on Channel 2
....			…
Satellite Used1			SV on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR><LF>			End of message termination

Table 16 Mode 1

Value	Description
M	Manual – forced to operate in 2D or 3D mode
A	2D Automatic – allowed to automatically switch 2D/3D

Table 17 Mode 2

Value	Description
1	Fix Not Available
2	2D (< 4 SV's used)
3	3D (> 3 SV's used)

- **GSV—GNSS Satellites in View**

Table 16 contains the values for the following example:

$GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42*71
$GPGSV, 2, 2, 07, 09, 23, 313, 42, 04, 19, 159, 41, 15, 12, 041, 42*41

Table 18 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages1	2		Range 1 to 3
Message Number1	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79		Channel 1 (Maximum 90)
Azimuth	048		Channel 1 (True, Range 0 to 359)
SNR (C/No)	42		Range 0 to 99, null when not tracking
....			....
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27		Channel 4 (Maximum 90)
Azimuth	138		Channel 4 (True, Range 0 to 359)
SNR (C/No)	42		Range 0 to 99, null when not tracking
Checksum	*71		
<CR><LF>			End of message termination

- **MSS—MSK Receiver Signal**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 17 contains the values for the following example:

```
$GPMSS,55,27,318.0,100,*66
```

Table 19 MSS Data Format

Name	Example	Units	Description
Message ID	$GPMSS		MSS protocol header
Signal Strength	55	DB	SS of tracked frequency
Signal-to-Noise Ratio	27	DB	SNR of tracked frequency
Beacon Frequency	318.0	KHz	Currently tracked frequency
Beacon Bit Rate	100		Bits per second
Channel Number	1		The channel of the beacon being used if a multi-channel beacon receiver is used
Checksum	*57		
<CR><LF>			End of message termination

Note – The MSS NMEA message can only be polled or scheduled using the MSK NMEA input message. See “MSK—MSK Receiver Interface”.

- **RMC—Recommended Minimum Specific GNSS Data**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 18 contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table 20 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status1	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over Ground	309.62	Degrees	True
Date	120598		ddmmyy
Magnetic Variation2		Degrees	E=east or W=west
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*10		
<CR><LF>			End of message termination tracking

1. A valid status is derived from the SiRF Binary M.I.D 2 position mode. See the SiRF Binary Reference Manual.
2. Samsung GPS receiver does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

- **VTG—Course Over Ground and Ground Speed**

Note – Fields marked in red apply only to NMEA version 2.3 (and later) in this NMEA message description.

Table 19 contains the values for the following example:

```
$GPVTG,309.62,T,  ,M,0.13,N,0.2,K*6E
```

Table 21 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*6E		
<CR> <LF>			End of message termination tracking

Samsung GPS receiver does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

5.2. Input Messages

NMEA input messages are provided to allow you to control Samsung GPS Receiver while in NMEA protocol mode.

5.2.1. Transport Message

Table 22 Transport message parameters

Start Sequence	Payload	Checksum	End Sequence
$PSRF<MID>	Data	*CKSUM	<CR><LF>

1. Message Identifier consisting of three numeric characters. Input messages begin at MID 100.
2. Message specific data. Refer to a specific message section for <data>...<data>

definition.

3. CKSUM is a two-hex character checksum as defined in the NMEA specification. Use of checksums is required on all input messages.
4. Each message is terminated using Carriage Return (CR) Line Feed (LF) which is \r\n which is hex 0D 0A. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message.

Note – All fields in all proprietary NMEA messages are required, none are optional. All NMEA messages are comma delimited.

5.2.2. NMEA Input Messages

Table 23 NMEA input messages

Message	MID1	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z2
SetDGPSPort	102	Set PORT B parameters for DGPS input
Query/Rate Control	103	Query standard NMEA message and/or set output rate
LLANavigationInitialization	104	Parameters required for start using Lat/Lon/Alt3
Development Data On/Off	105	Development Data messages On/Off
Poll SW version	109	Poll Samsung & SiRF SW version
Start mode	110	set start mode
MSK Receiver Interface	MSK	Command message to a MSK radio-beacon receiver.

1. Message Identification (MID)
2. Input coordinates must be WGS84.

Note – NMEA input messages 100 to 105 are SiRF proprietary NMEA messages. The MSK NMEA string is as defined by the NMEA 0183 standard.

Table 22 provides a summary of supported Samsung & SiRF NMEA input messages by the specific Samsung platforms.

Table 24 Supported NMEA input messages

Message ID	SiRF Software Options			
	GSW2	SiRFXTrac	GSW3	SiRFLoc
100	Yes	Yes	Yes	Yes
101	Yes	Yes	Yes	Yes
102	Yes	No	Yes	No
103	Yes	Yes	Yes	Yes
104	Yes	Yes	Yes	Yes
105	Yes	Yes	Yes	Yes
109	No	Yes	Yes	No
110	No	Yes	Yes	No
MSK	Yes	No	Yes	No

- **100—SetSerialPort**

This command message is used to set the protocol (SiRF Binary or NMEA) and/or the communication parameters (baud, data bits, stop bits, parity). Generally, this command is used to switch the module back to SiRF Binary protocol mode where a more extensive command message set is available. When a valid message is received, the parameters are stored in battery-backed SRAM and then the Evaluation Receiver restarts using the saved parameters.

Table 23 contains the input values for the following example:

```
Switch to SiRF Binary protocol at 9600,8,N,1
$PSRF100,0,9600,8,1,0*0C
```

Table 25 Set Serial Port Data Format

Name	Example	Units	Description
Message ID	$PSRF100		PSRF100 protocol header
Protocol	0		0=SiRF Binary, 1=NMEA
Baud	9600		4800, 9600, 19200, 38400
Data Bits	8		8, 7
Stop Bits	1		0, 1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*0C		
<CR><LF>			End of message termination

Note – Samsung GPS receiver does not need protocol switching to SiRF binary or NMEA protocol because Samsung GPS receiver outputs NMEA thru UARTA and SiRF binary thru UARTB. Protocol switching is unavailable because the same protocol, either SiRF binary or NMEA, can not exist on both UARTA & UARTB at the same time. So, Use UARTA for NMEA protocol and use UARTB for SiRF binary protocol. But, Other settings such as Baud, data Bits and so on can be achieved by issuing this command.

- **101—NavigationInitialization**

This command is used to initialize the Evaluation Receiver by providing current position (in X, Y, Z coordinates), clock offset, and time. This enables the Evaluation Receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters enable the Evaluation Receiver to acquire signals quickly.

Table 24 contains the input values for the following example:

Start using known position and time.
$PSRF101, -2686700, -4304200, 3851624, 96000, 497260, 921, 12, 3*1C

Table 26 Navigation Initialization Data Format

Name	Example	Units	Description
Message ID	$PSRF101		PSRF101 protocol identifier
ECEF X	-2686700	meters	X coordinate position
ECEF Y	-4304200	meters	Y coordinate position
ECEF Z	3851624	meters	Z coordinate position
ClkOffset	96000	Hz	Clock Offset of the Evaluation Receiver1
TimeOfWeek	497260	seconds	GPS Time Of Week
WeekNo	921		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See Table 25 and Table 26
Checksum	*1C		
<CR><LF>			End of message termination

1. Use 0 for last several value if available. If this is unavailable, a default value 96,000 will be used.

Table 27 Reset Configuration - Non SiRFLoc Platforms

Hex	Description
0x01	Hot Start— All data valid
0x02	Warm Start—Ephemeris cleared
0x03	Warm Start (with Init)—Ephemeris cleared, initialization data loaded
0x04	Cold Start—Clears all data in memory
0x08	Clear Memory—Clears all data in memory and resets receiver back to factory defaults

Table 28 Reset Configuration – SiRFLoc Specific

Hex	Description
0x00	Perform a hot start using internal RAM data. No initialization data will be used.
0x01	Use initialization data and begin in start mode. Uncertainties are 5 sec time accuracy and 300 km position accuracy. Ephemeris data in SRAM is used.
0x02	No initialization data is used, ephemeris data is cleared, and warm start performed using remaining data in RAM.
0x03	Initialization data is used, ephemeris data is cleared, and warm start performed using remaining data in RAM.
0x04	No initialization data is used. Position, time and ephemeris are cleared and a cold start is performed.
0x08	No initialization data is used. Internal RAM is cleared and a factory reset is performed.

- **102—SetDGPSPort**

This command is used to control the serial port used to receive RTCM differential corrections. Differential receivers may output corrections using different communication parameters. If a DGPS receiver is used which has different communication parameters, use this command to allow the receiver to correctly decode the data. When a valid message is received, the parameters are stored in battery-backed SRAM and then the receiver restarts using the saved parameters.

Table 27 contains the input values for the following example:

Set DGPS Port to be 9600,8,N,1.
$PSRF102, 9600, 8, 1, 0*12

Table 29 Set DGPS Port Data Format

Name	Example	Units	Description
Message ID	$PSRF102		PSRF102 protocol header
Baud	9600		4800, 9600, 19200, 38400
DataBits	8		8,7
StopBits	1		0,1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*12		
<CR><LF>			End of message termination

- **103—Query/Rate Control**

This command is used to control the output of standard NMEA messages GGA, GLL, GSA, GSV, RMC, and VTG. Using this command message, standard NMEA messages may be polled once, or setup for periodic output. Checksums may also be enabled or disabled depending on the needs of the receiving program. NMEA message settings are saved in battery-backed memory for each entry when the message is accepted.

Table 28 contains the input values for the following examples:

1. Query the GGA message with checksum enabled
   $PSRF103, 00, 01, 00, 01*25

2. Enable VTG message for a 1 Hz constant output with checksum enabled
   $PSRF103, 05, 00, 01, 01*20

3. Disable VTG message
   $PSRF103, 05, 00, 00, 01*21

Table 30 Query/Rate Control Data Format (See example 1)

Name	Example	Units	Description
Message ID	$PSRF103		PSRF103 protocol header
Msg	00		See table 29.
Mode	01		0=SetRate, 1=Query
Rate	00		Output-Off=0, max=255
CksumEnable	01		0=Disable Checksum, 1=Enable Checksum
Checksum	*25		
<CR><LF>			End of message termination

Table 31 Messages

Value	Description
0	**GGA**
1	**GLL**
2	**GSA**
3	**GSV**
4	**RMC**
5	**VTG**

Note – In TricklePower mode, update rate is specified by the user. When you switch to NMEA protocol, message update rate is also required. The resulting update rate is the product of the TricklePower Update rate and the NMEA update rate (i.e., TricklePower update rate = 2 seconds, NMEA update rate = 5 seconds, resulting update rate is every 10 seconds, (2 X 5 = 10)).

- **104—LLANavigationInitialization**

This command is used to initialize Samsung GPS receiver by providing current position (in latitude, longitude, and altitude coordinates), clock offset, and time. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters enable the receiver to acquire signals quickly.

Table 30 contains the input values for the following example:

Start using known position and time.
$PSRF104, 37. 3875111, -121. 97232, 0, 96000, 237759, 1946, 12, 1*07

Table 32 LLA Navigation Initialization Data Format

Name	Example	Units	Description
Message ID	$PSRF104		PSRF104 protocol header
Lat	37.3875111	Degrees	Latitude position (Range 90 to –90)
Lon	-121.97232	Degrees	Longitude position (Range 180 to –180)
Alt	0	Meters	Altitude position
ClkOffset	96000	Hz	Clock Offset of the Evaluation Receiver
TimeOfWeek	237759	Seconds	GPS Time Of Week
WeekNo	1946		Extended GPS Week Number (1024 added)
ChannelCount	12		Range 1 to 12
ResetCfg	1		See Table 31
Checksum	*07		
<CR><LF>			End of message termination

Table 33 LLA Navigation Initialization Data Format

Hex	Description
0x01	Hot Start— All data valid
0x02	Warm Start—Ephemeris cleared
0x03	Warm Start (with Init)—Ephemeris cleared, initialization data loaded
0x04	Cold Start—Clears all data in memory
0x08	Clear Memory—Clears all data in memory and resets receiver back to factory defaults

- **105—Development Data On/Off**

Use this command to enable development data information if you are having trouble getting commands accepted. Invalid commands generate debug information

that enables the user to determine the source of the command rejection. Common reasons for input command rejection are invalid checksum or parameter out of specified range.

Table 32 contains the input values for the following examples:

1. Debug On
   $PSRF105,1*3e

2. Debug Off
   $PSRF105,0*3e

Table 34 Development Data On/Off Data Format

Name	Example	Units	Description
Message ID	$PSRF105		PSRF105 protocol header
Debug	1		0=Off, 1=On
Checksum	*3e		
<CR><LF>			End of message termination

- **109—PollSWVersion (Samsung Specific NMEA command)**

Use this command to poll sw version. Before issuing PollSWVersion, Debug On mode should be activated by issuing $PSRF105,1*3E first. Then, this command will make Samsung GPS receiver to return its SW version.

Table 33 contains the input values for the following examples:

Poll Sw version
$PSRF109*2f

Table 35 PollSWVersion Data Format

Name	Example	Units	Description
Message ID	$PSRF109		PSRF109 protocol header
Checksum	*2f		
<CR><LF>			End of message termination

- **110—SetStartMode (Samsung Specific NMEA command)**

This command is used to set the start mode of Samsung GPS receiver. The used can set the start mode of the receiver to one of Hot / Warm / Cold / Factory start.

Table 34 contains the input values for the following examples:

1. Set to Hot start mode
   $PSRF110, 1*3a

2. Set to Warm start mode
   $PSRF110, 2*39

3. Set to Warm start mode with initialization data loaded
   $PSRF110, 3*38

4. Set to Cold start mode
   $PSRF110, 4*3f

5. Set to Factory start mode
   $PSRF110, 8*33

Table 36 SetStartMode Data Format

Name	Example	Units	Description
Message ID	$PSRF110		PSRF104 protocol header
StartMode	1		StartMode (1, 2, 3, 4, 8)
Checksum	*3a		
<CR><LF>			End of message termination

Table 37 Reset Configuration

Hex	Description
0x01	Hot Start— All data valid
0x02	Warm Start—Ephemeris cleared
0x03	Warm Start (with Init)—Ephemeris cleared, initialization data loaded
0x04	Cold Start—Clears all data in memory
0x08	Clear Memory—Clears all data in memory and resets receiver back to factory defaults

- **MSK—MSK Receiver Interface**

Table 36 contains the values for the following example:
$GPMSK,318.0,A,100,M,2,*45

Table 38 MSK Data Format

Name	Example	Units	Description
Message ID	$GPMSK		MSK protocol header
Beacon Frequency	318.0	KHz	Frequency to use
Auto/Manual Frequency	A		A : Auto, M : Manual
Beacon Bit Rate	100		Bits per second
Auto/Manual Bit Rate	M		A : Auto, M : Manual
Interval for Sending $--MSS2	2	sec	Sending of MSS messages for status

1. If Auto is specified the previous field value is ignored.
2. When status data is not to be transmitted this field is null.

Note – The NMEA messages supported by the Evaluation Receiver does not provide the ability to change the DGPS source. If you need to change the DGPS source to internal beacon, then this must be done using the SiRF binary protocol and then switched to NMEA.

6. Testing

This section describes environmental requirements and test condition of SGEM.

6.1. Test condition

Test can be performed in the following order (5.2. Test method)
If there are no special requirements, test conditions below will be applied.

Table 39 Test Condition

Item	Description
Voltage	Typ 5.0 ± 0.5% VDC
Ambient temperature	+20℃ to +25℃
Air pressure	Atmospheric pressure

DUT is in the operation mode during each test or after each test.
DUT should be stored in each temperature for at least 2 hours before test begins.

6.2. Test method

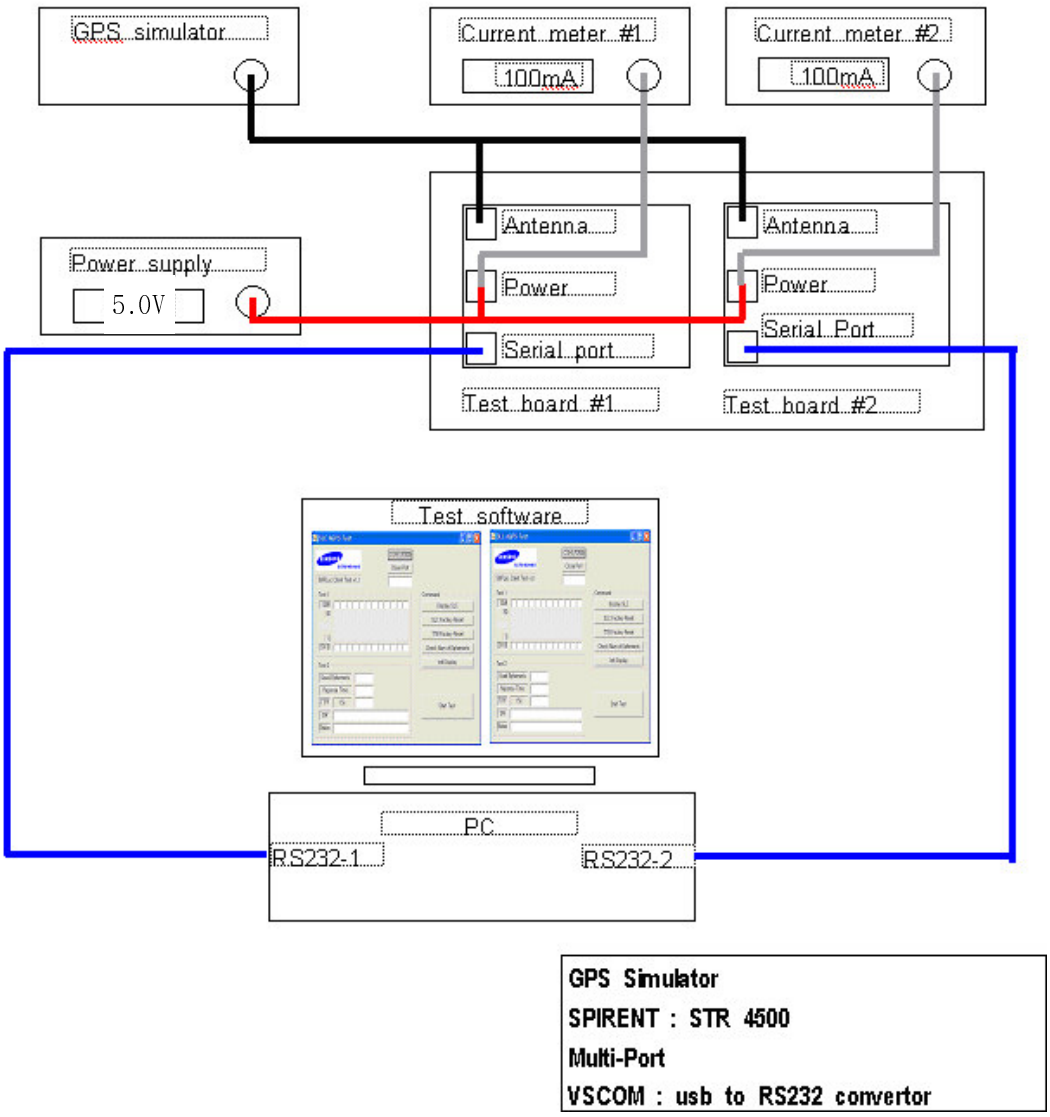


Figure 2 Test method

6.3. Test flow chart

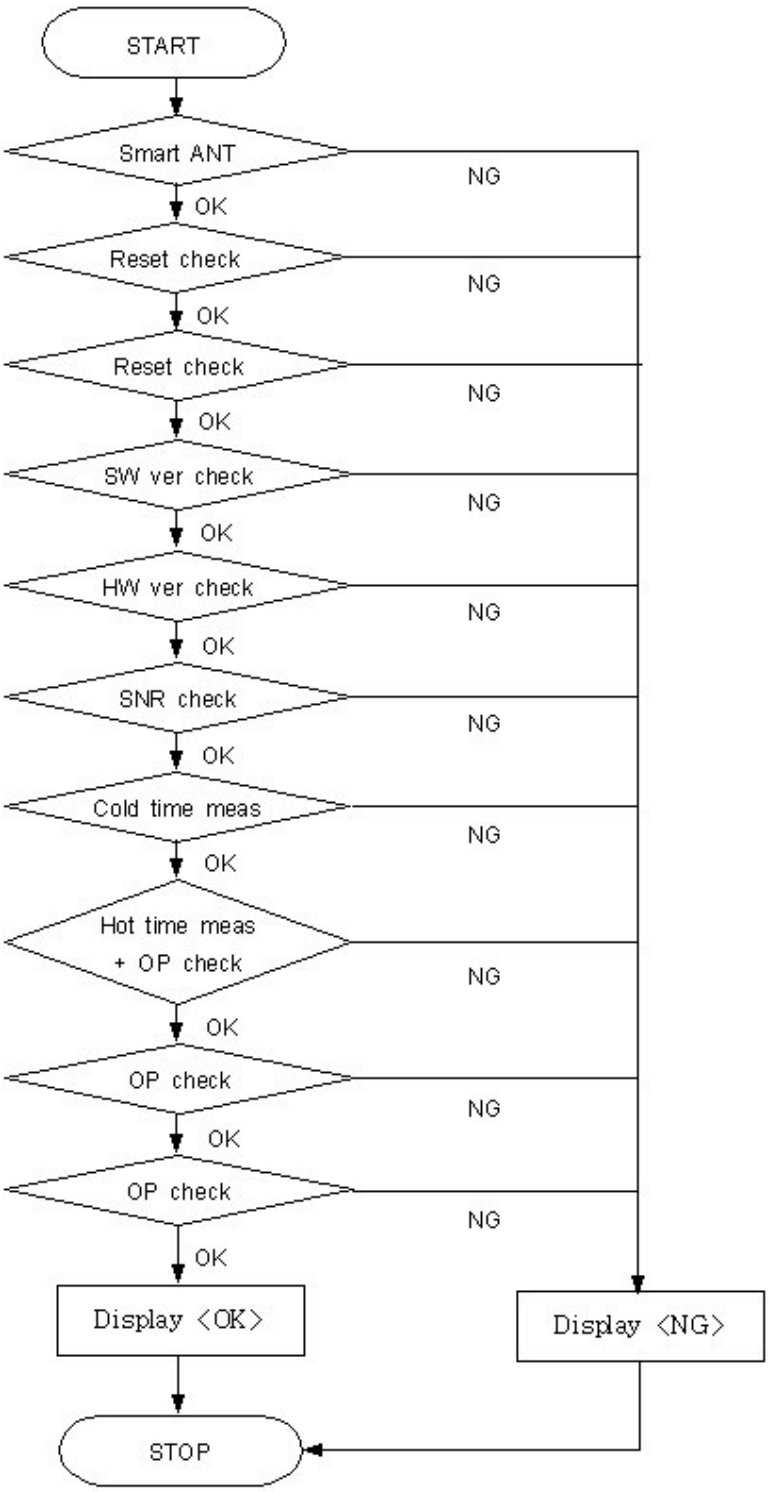


Figure 3 Test Flow Chart

6.4. Field trial tests

The supply voltage will be set to the given reference voltage while DUT parameters are being measured. These parameters include call communication Tx and Rx performance, serial port and I/O functionality and all defined function.

The product complies with the following tests over the entire voltage range.

Table 40 Field trial tests

Field Trial Test Environment	Temperature
Normal climate	+25℃
Cold environment	-20℃
Hot Environment	+70℃

6.5. Reliability Test

Table 41 Reliability Test

Performance	Characteristic	Unit	Target value	USL	LSL	Management Cpk
Cold Start	Time that take to Fix after Cold Start	Sec	55	75		1.5
Hot Start	Time that take to Fix after Hot Start	Sec	10	10		1.5
SN	RF performance confirmation	dB/Hz	38	40	36	1.5

7. Interface Specifications

7.1. Marking

External label includes Product number, Software version & type.

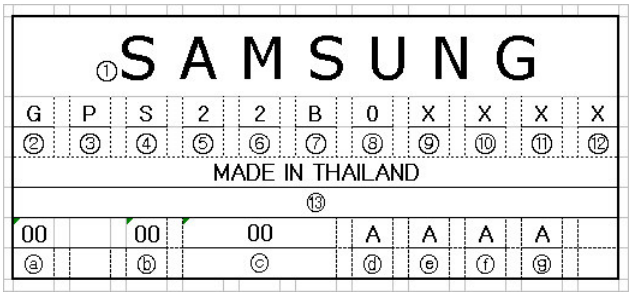


Figure 4 Marking

Table 42 Lot number

No	Content	Index	Content
1	Manufacturer	A	Year of manufacturing (Year 20XX)
2, 3, 4	Product type (GPS:Smart Type)	B	Month of manufacturing (Month 00)
5, 6	Size	C	Date of manufacturing (Data 00)
7	Chipset	D	Manufacturing line
8, 9	Customer	E	Drawing version
10, 11, 12	S/W version	F	Drawing version
13	Manufacturing site	G	Manufacturing specification revision

7.2. Connection configurations

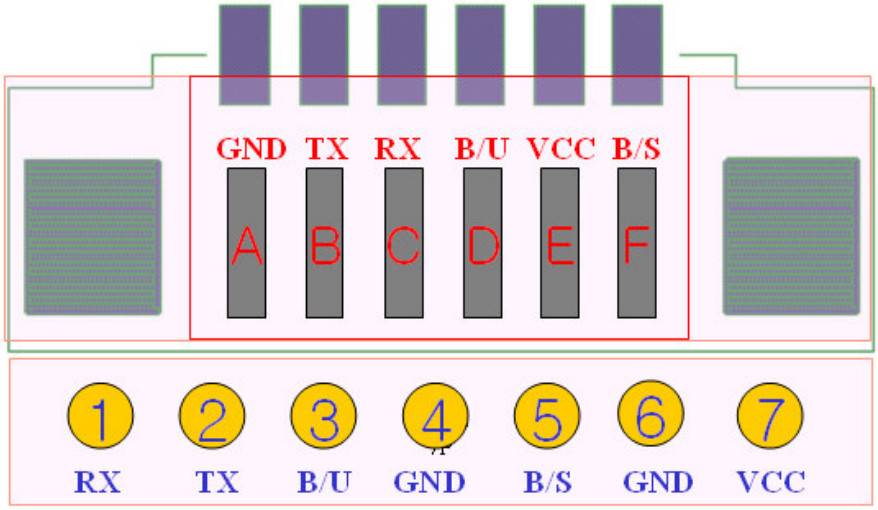


Figure 5 Connection configurations

Table 43 Pin Function

Solder Port No.	Pin No.	Name	Description
①	C	RX	CMOS level asynchronous input for Port 0
②	B	TX	CMOS level asynchronous output for Port 0
③	D	B/U	Keep NC
④	A	GND	Ground
⑤	F	B/S	Keep NC for normal operation.
⑥	A	GND	Ground
⑦	E	VCC	Main Power Supply (Typ 5.0V)

8. Mechanical Dimensions

8.1. Schematic Drawing of Module

8.1.1. Part Lists of GPS Module

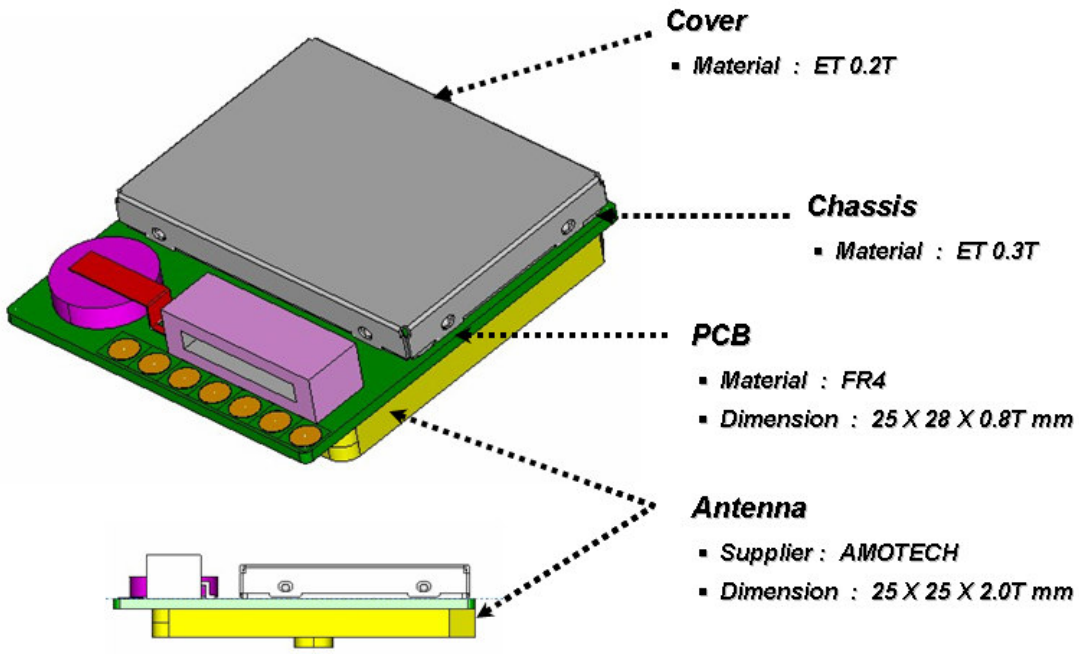
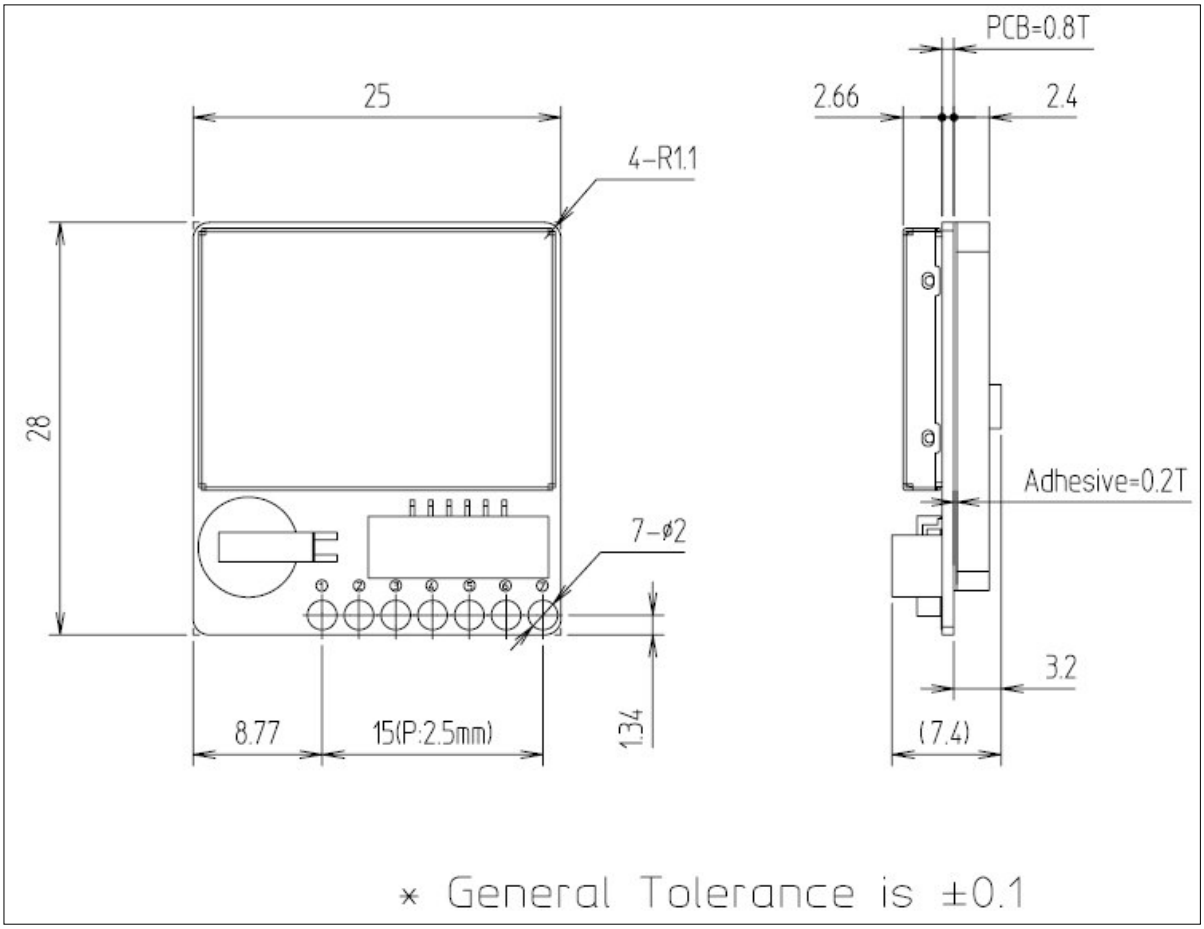


Figure 6 Part Lists of GPS Module

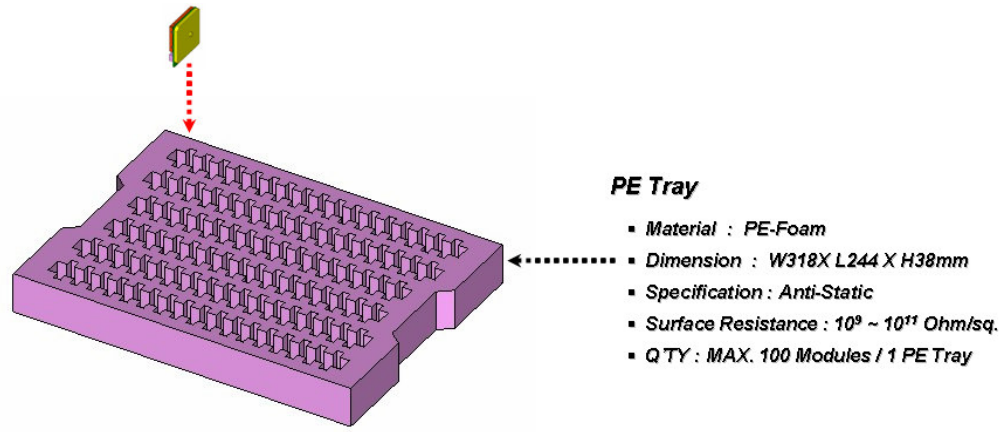
8.1.2. Outline Drawing



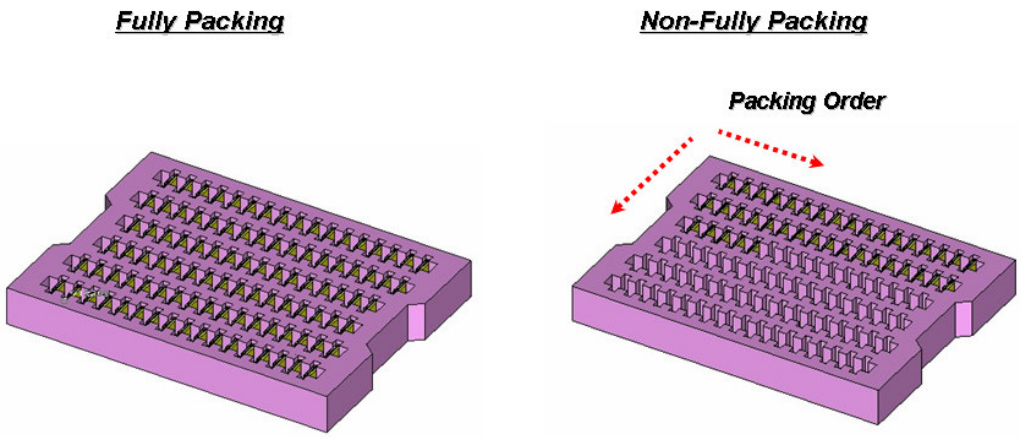
Appendix A. Package Specifications

Appendix A-1. Tray Packing

Appendix A-1-1. PE Foam Tray Packing

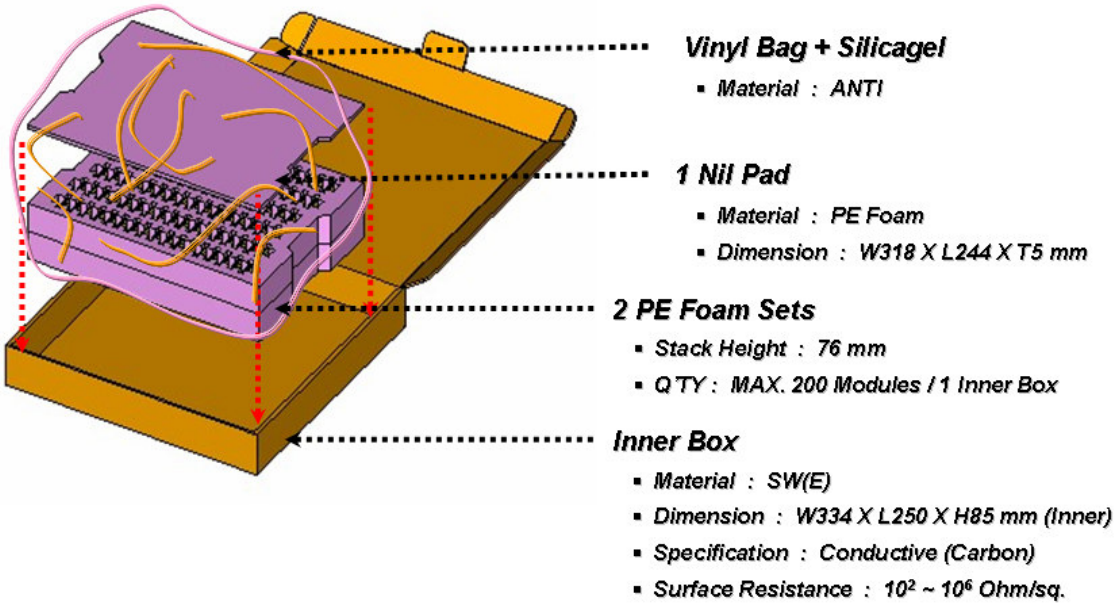


Appendix A-1-2. Non-Fully Packing Method

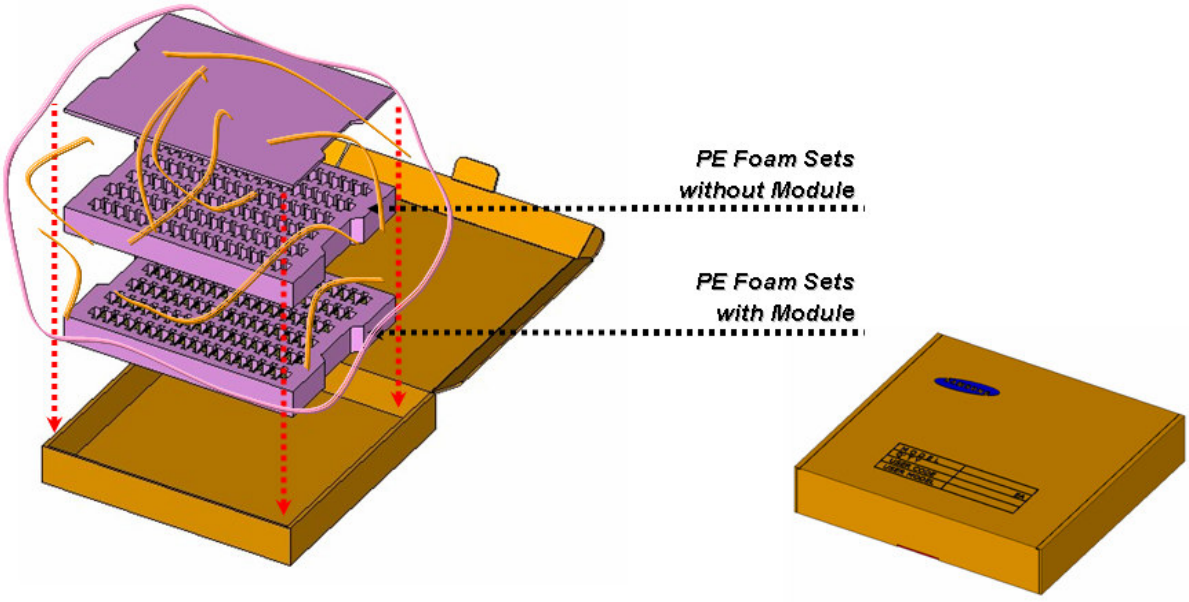


Appendix A-2. Inner Box Packing

Appendix A-2-1. Inner Box Packing Method

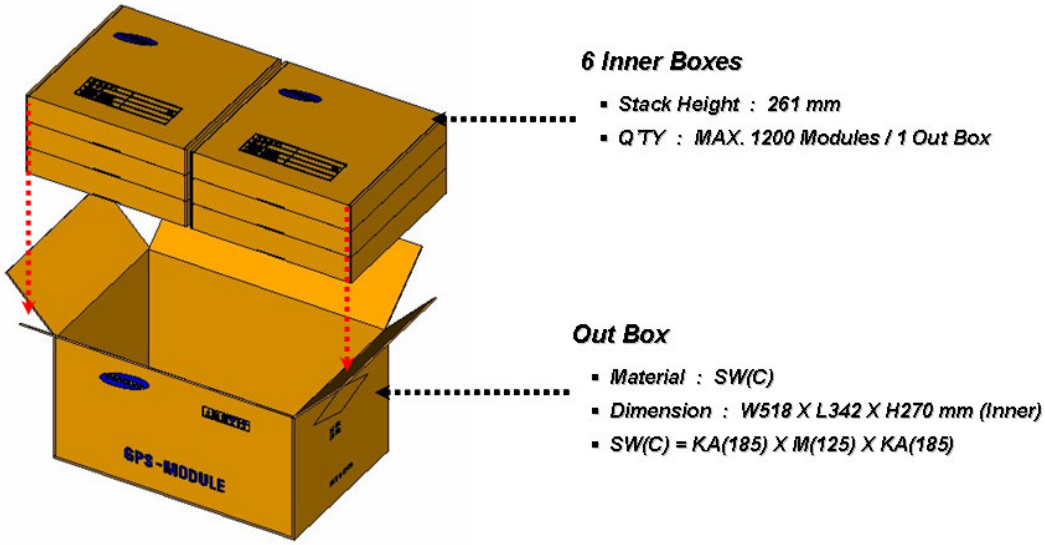


Appendix A-2-2. Non-Fully Packing

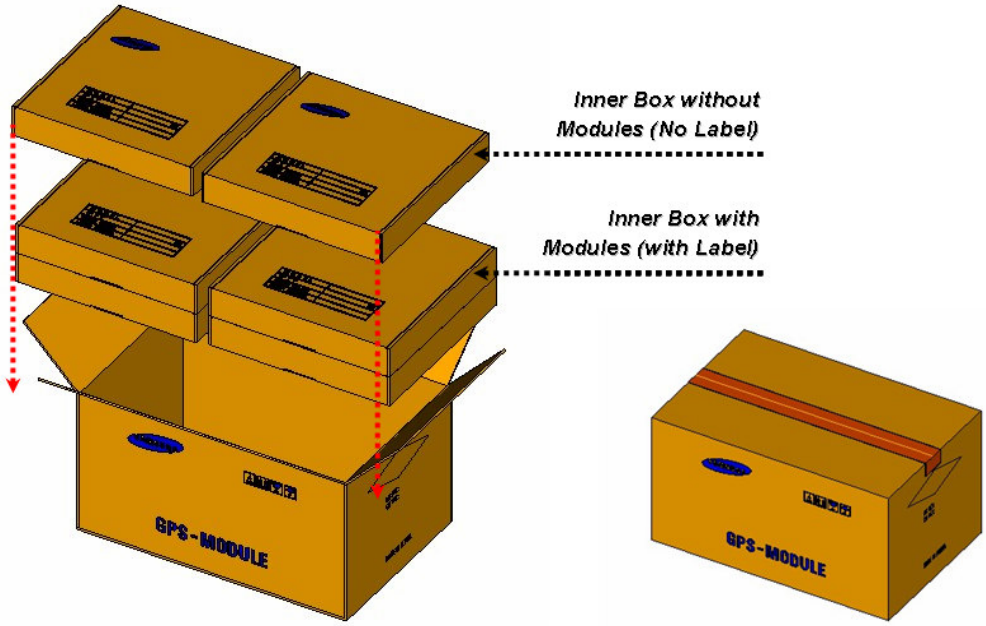


Appendix A-3. Out Box Packing

Appendix A-3-1. Out Box Packing Method

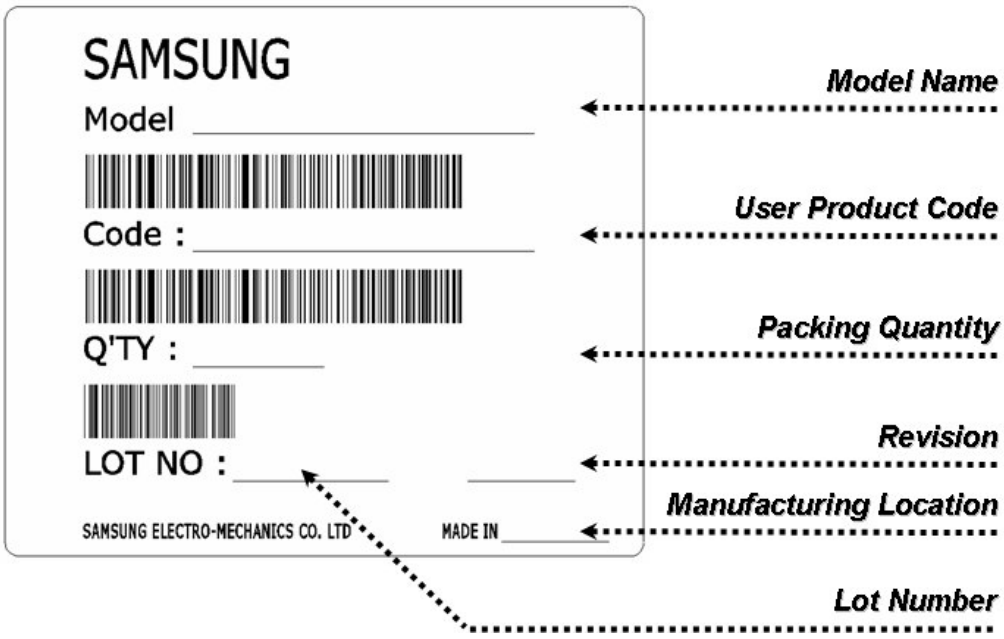


Appendix A-3-2. Non-Fully Packing

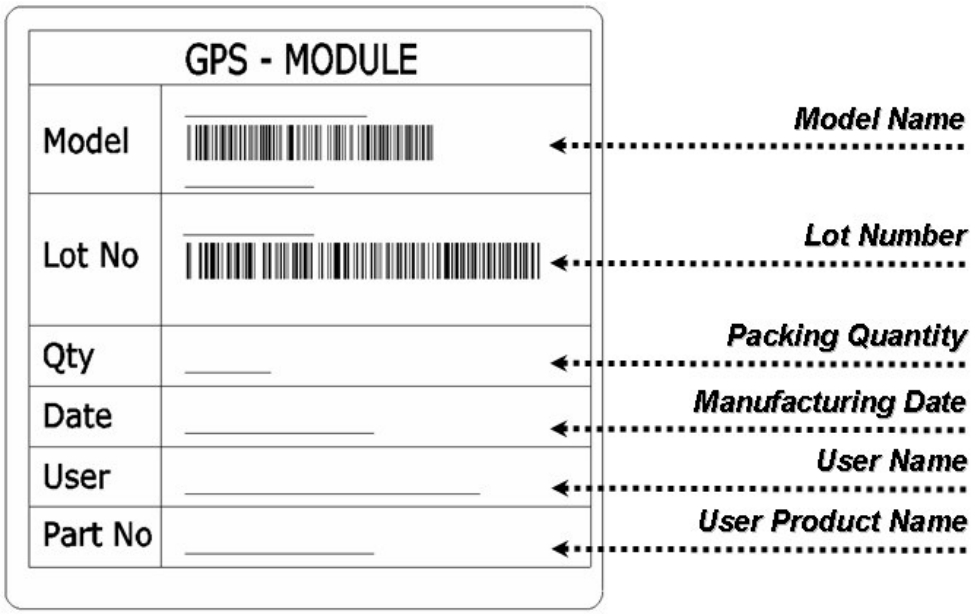


Appendix A-4. Label

Appendix A-4-1. Description of Rating Label (70mm X 60mm)

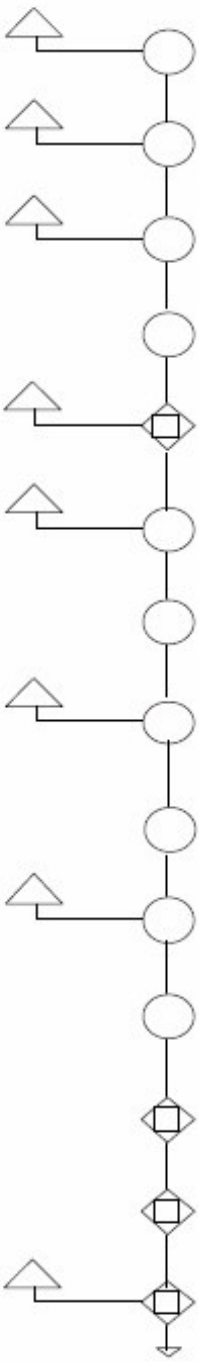
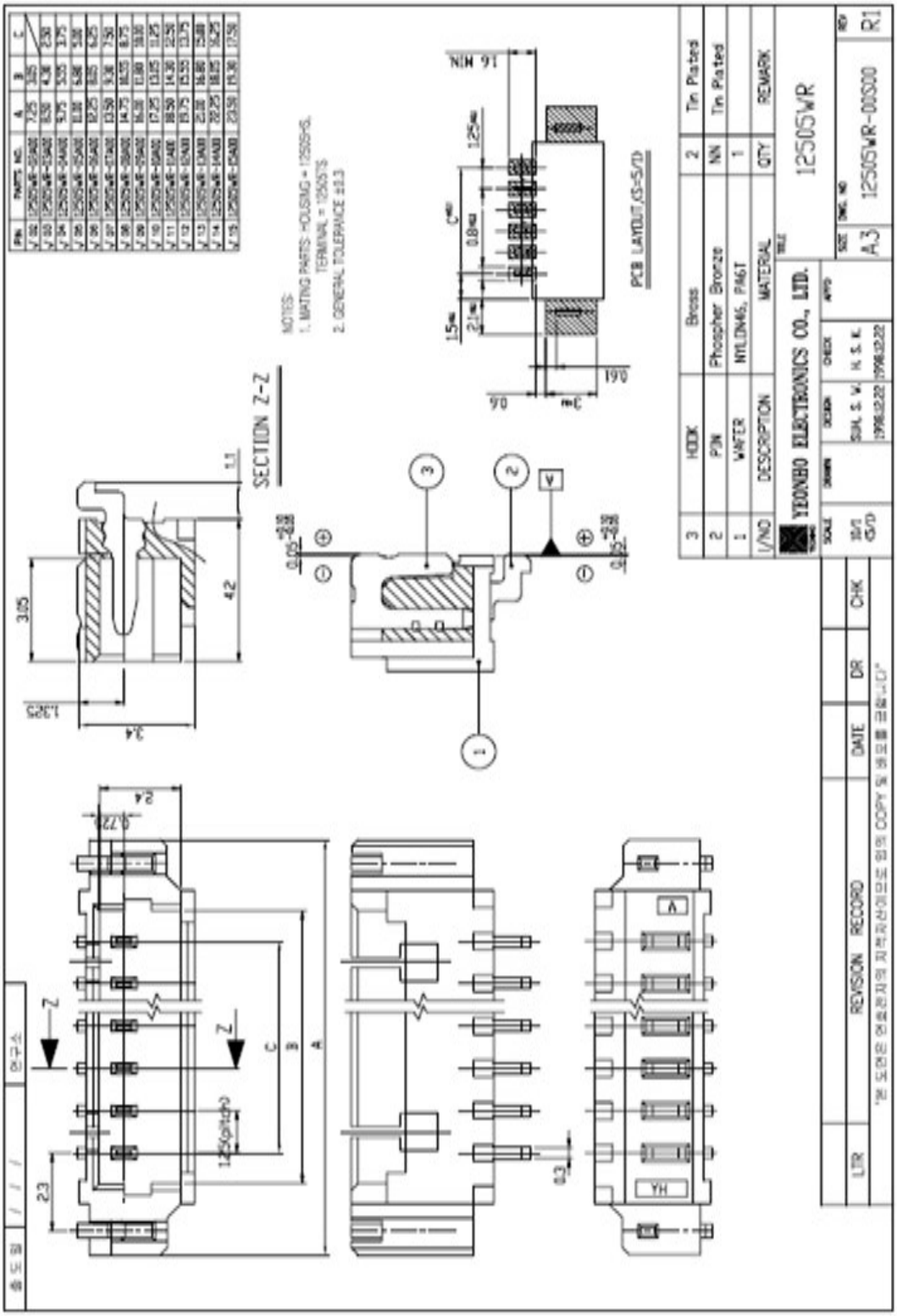


Appendix A-4-2. Description of Out Box Label (100mm X 100mm)`



Appendix B. Manufacturing process

모델명	GPS-MODULE	제 조 표 준 서	페이지번호	1-1
작성자	곽 문 호	구 분	공정도(FLOW CHART)	

공 정 도	공 정 명	사용설비 및 치공구	관련자료 및 사용서식
	PCB 검사 및 공급	확대경, 핀셋	관리공정도,체크시트
	SOLDER 도포(TOP면)	크림솔다 도포 M/C	관리공정도,체크시트
	CHIP장착(TOP면)	CHIP M/C	관리공정도,체크시트
	경화(TOP면)	경화로, 핀셋	관리공정도,체크시트
	CHIP ASS'Y 검사	확대경, 인두, 핀셋	제조표준서
	COVER 조립	핀셋, 롱로즈, 닛퍼	제조표준서
	LASER 마킹	레이저 마킹 M/C	제조표준서
	SOLDER 도포(BOTTOM면)	크림솔다 도포 M/C	제조표준서
	SOLDER 경화(BOTTOM면)	경화로, 핀셋	제조표준서
	TAPING	TAPING M/C	제조표준서
	DICING 및 CLEANING	DICING M/C	제조표준서
		CLEANING M/C	
	펌웨어파일 다운로드	측정지그,PC, 전류메타, POWER SUPPLY	제조표준서
	동작검사	시뮬레이터, 측정지그, 신호종폭기, PC, 전류메타	제조표준서
		POWER SUPPLY,위성수신 안테나, 케이블	
	포장	TAPING M/C	제조표준서
		진공포장기 M/C	

Appendix C. 12505WR-06 Pin datasheet